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UNILATERAL NEGLECT: FURTHER VALIDATION OF THE BAKING TRAY TASK

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Objective: **The Baking Tray Task is a comprehensible, simple-to-perform test for use in assessing unilateral neglect. The aim of this study was to validate further its use with stroke patients.**

Methods: **The Baking Tray Task was compared with 2 versions of the Behaviour Inattention Test and a test for personal neglect. A total of 270 patients were subjected to a 3-item version of the Behaviour Inattention Test and 40 patients were subjected to an 8-item version of the Behaviour Inattention Test, besides the Baking Tray Task and the personal neglect test.**

Results: **The Baking Tray Task was more sensitive than the 3-item Behaviour Inattention Test, but the 8-item Behaviour Inattention Test was more sensitive than the Baking Tray Task. The best combination of any 3 tests was Baking Tray Task, Reading an article, and Figure copying; the 2 last-mentioned being a part of the 8-item Behaviour Inattention Test.**

Conclusion: **Multi-item tests detect more cases of neglect than do single tests. However, it is tiresome for the patient to undergo a larger test battery than necessary. It is also time-consuming for the staff. Behavioural tests seem more appropriate when assessing neglect. The Baking Tray Task seems to be one of the most sensitive single tests, but its sensitivity can be further enhanced when it is used in combination with other tests.**

Key words: stroke, perceptual disorders, assessment.

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INTRODUCTION

There is a need for simple reliable tests for assessing patients with stroke for unilateral neglect (UN). UN is often task-specific (1) and may therefore escape detection if too limited a test battery is used. In addition, patients may be able to compensate for UN if they are allowed to concentrate fully on the test task (2). Therefore multi-item test-batteries have been devised, for example the Behaviour Inattention Test (BIT) (3, 4), consisting of 6 paper-and-pen subtests and 9 "behavioural" subtests, in the hope that UN will be revealed in at least 1 of the subtests. One of the disadvantages of such test batteries is that they are tiresome for many patients, who often are unable to complete all the subtests. In addition, they are time-consuming to perform for the staff. Therefore, condensed versions of the BIT have been presented, for example an 8-item version (m-BIT) (5) and a 3-item version (s-BIT) (6). The disadvantage with the m-BIT is that it is still an extensive and demanding test. The disadvantage with the s-BIT is that it embraces no behavioural measures, which are thought to increase the face validity and to be more ecologically appropriate (4). A recently developed behavioural test, the Baking Tray Task (BTT), is easy to perform, yet sensitive (7). However, documentation regarding its validity is limited. The aim of this paper was to compare the BTT with the s-BIT, the m-BIT and a test of personal neglect (PN) (8), in order to establish an economical, yet reliable method of testing UN. A further aim was to describe different performance patterns of BTT that are difficult to interpret.

METHODS

Comparison with the s-BIT

A total of 377 patients (209 women and 168 men, mean age 76.6 years) with a first-ever non-subarachnoidal stroke were included in a stroke incidence study (9). The median National Institutes of Health Stroke Scale (NIHSS) score was 6. Of these patients 162 had a right-sided stroke, 200 a left-sided stroke and 15 a stroke of bilateral or unknown location.

Nineteen patients were discovered retrospectively and 9 patients denied consent. An additional 19 patients died within the first 3 days. Therefore, 330 patients were subjected to the s-BIT, the BTT and a test for PN. Tests were performed 1–3 days after the event. The s-BIT comprises 3 subtests, the Line cancellation test (Albert's test), the Letter cancellation test and the Line bisection test. In the BTT, patients are asked to spread out 16 cubes as evenly as possible over a board, "as if they were buns on a baking tray" (Fig. 1). The methodology is explained in more detail in a separate paper (10). According to Samuelsson et al. (11), we included a measure of asymmetry in our assessment criteria, in order to exclude patients with non-lateralized attentional deficits only.

Comparison with the m-BIT

Forty patients (24 women and 16 men, mean age 74 years), recruited from 2 centres, were included in the study, the main design of which has been described elsewhere (12). The median NIHSS at 2–4 weeks was 11, indicating that these patients had somewhat more severe strokes than average. All the patients had their lesions located in the right side of the brain.

These patients were subjected to the BTT and the m-BIT 2–4 weeks after the event, after 6 months and after 1 year. They all had some degree of UN, which had been previously diagnosed with the s-BIT and/or

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Fig. 1. A patient performing the Baking Tray Task.

the BTT. The m-BIT consists of the following 8 subtests: Pointing to objects, Food on a plate, Reading a menu, Reading an article, Line cancellation, Star cancellation, Coin selection and Figure copying. Before doing analyses, the results of each test were dichotomized according to the cut-offs on each test.

RESULTS

BTT

Six examples of BTT results are shown in Fig. 2. A few patients tend to build "figures", like the examples (d), (e) and (f). Such patients seem to have forgotten or misunderstood the instructions, and always showed signs of a low cognition, either in terms of a low score (1–2) on item 1 b on the NIHSS, or a low score (<24) on a Mini-Mental State Examination. These patients did not show any other signs of UN.

Comparison with the s-BIT

Of the 330 patients, 270 were able to complete at least 1 of the 3 subtests of s-BIT and the BTT. A total of 267 patients performed the PN test. The reasons that some patients did not

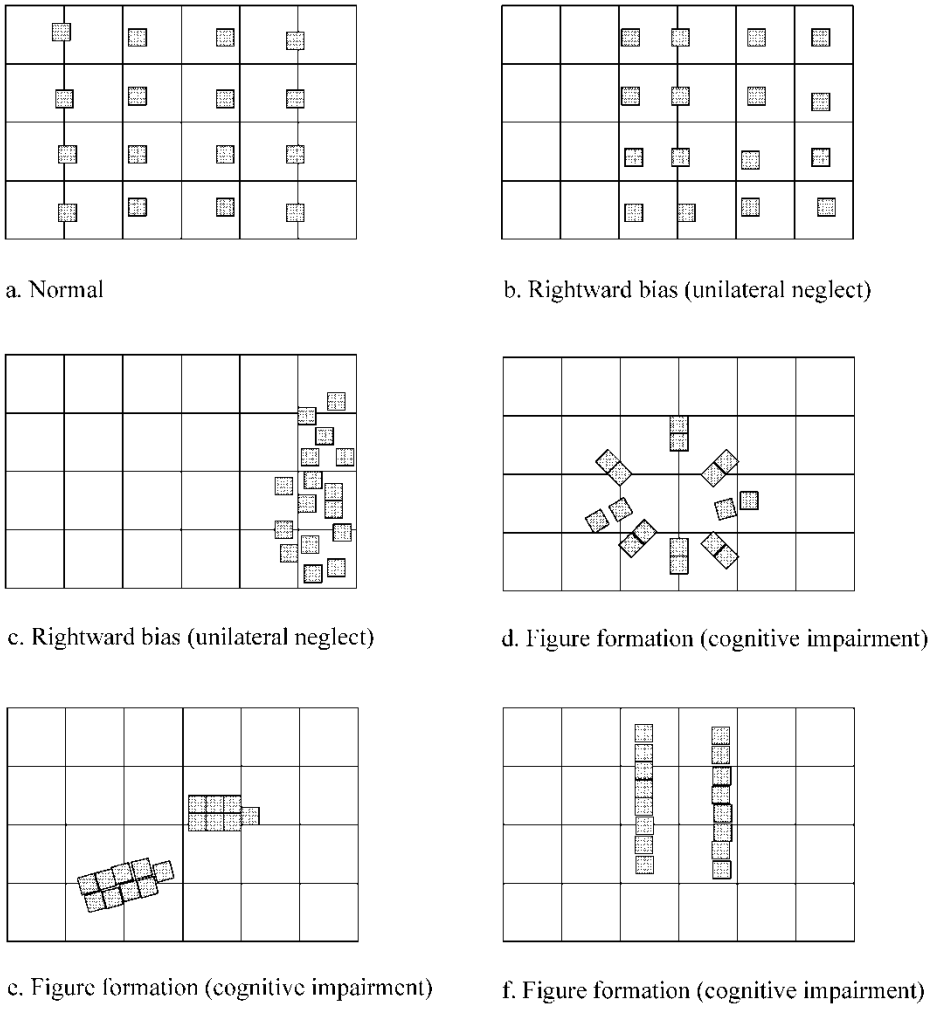

Fig. 2. The Baking Tray Task: some different performance patterns. Example (a) is a typical normal result. The cubes are uniformly spread over the board. Example (b) and (c) show different grades of UN with a rightward bias of the cube placement. Example (d), (e) and (f) are examples of figure formation. The grid, which is shown in the examples, is not visible to the patient. It is applied after the patient has placed the cubes and is used for scoring only.

Table I. *The Behaviour Inattention Test (3-item version) (s-BIT) and personal neglect (PN) test vs the Baking Tray Task (BTT) in 270 patients with first-ever stroke*

	Both tests negative	Both tests positive	BTT positive, the other negative	BTT negative, the other positive	Kappa-value
Line cancellation (n = 246)	196	22	28	0	0.56
Letter cancellation (n = 236)	188	20	26	2	0.53
Line bisection (n = 238)	183	24	24	7	0.53
s-BIT total (n = 249)	191	30	20	8	0.62
PN test (n = 261)	211	18	32	0	0.48

manage to perform the tests were low level of consciousness, low cognitive level, aphasia or apraxia. As is evident from Table I, BTT is more sensitive than any of the 3 subtests in the s-BIT, and even more sensitive than the 3 subtests taken together. However, 8 cases were missed when only the BTT was used. If the BTT was combined with the Line bisection test, only 1 case was missed.

Comparison with the m-BIT

There were a total of 101 test occasions, 40 at 2–4 weeks, 33 at 6 months and 28 at 1 year. The reason for the drop off at follow-ups were stroke recurrence (2 cases at 6 months), mental illness (1 case at 1 year) and mortality (5 cases at 6 months, and 4 cases at 1 year). Because of patient tiredness or cognitive difficulties, not all the m-BIT subtests were performed at all times. At 80 test occasions (79%) patients were able to complete all m-BIT subtests. As is evident from Table II, the m-BIT was more sensitive than the BTT in detecting UN. The BTT, however, was more sensitive than any individual item in the m-BIT, with the exception of Figure copying. The kappa-value was lowest between BTT and Pointing at objects, and between BTT and Figure copying.

The best combination of any 3 tests is BTT, Reading an article, and Figure copying. Such a combination detects all cases of UN, except 1.

DISCUSSION

We have shown that BTT is one of the most sensitive single tests in this study for detecting UN. BTT is even more sensitive than the combination of tests in s-BIT. The sensitivity can be further enhanced if Line bisection is combined with BTT. The m-BIT detects more cases of UN than BTT. The combination of BTT, Reading an article and Figure copying is more sensitive than the combination of 8 subtests in the m-BIT.

Individual patient fluctuations, involving for example motivation and fatigue, may play a role in whether or not UN is revealed in a certain situation (13). This is consistent with the fact that some patients in our study seem able to mask symptoms of UN. The results of 1 test may be pathological at baseline, normal after 6 months, but again pathological at 1 year. This stresses the importance of using several tests when assessing UN, and not relying solely on tests (14, 15).

When comparing the results of individual subtests, there is relatively high concordance between BTT and Reading a menu, but lower between BTT and Figure copying. There are several observations to support the view that UN can be divided into several components (16, 17). Using factor analysis, McGlinchey-Berroth et al. (18) found that Line bisection was a factor on its own, not closely associated with cancellation tests. Azouvi et al. (19) found that the performance on paper-and-pencil tests could be associated with 1 of 2 factors, the first requiring little motor activation, and the other requiring more complex motor behaviour.

These findings may explain some of the test observations in this study. Line bisection seems to diverge somewhat from the majority of tests. This may be because it evaluates a different component of UN than for example cancellation tests, but also

Table II. *The Behaviour Inattention Test (8-item version) (m-BIT) and personal neglect (PN) test vs the Baking Tray Task (BTT) in 40 patients with first-ever stroke at 2–4 weeks, at 6 months and at 1 year (101 different test occasions)*

	Both tests negative	Both tests positive	BTT positive, the other test negative	BTT negative, the other test positive	Kappa-value
Pointing at objects (n = 101)	29	22	44	6	0.13
Food on a plate (n = 99)	31	25	39	4	0.23
Reading a menu (n = 97)	26	40	24	7	0.37
Reading an article (n = 92)	17	44	16	15	0.26
Line cancellation (n = 98)	28	30	35	5	0.25
Star cancellation (n = 96)	24	37	27	8	0.29
Coin selection (n = 94)	29	35	25	5	0.39
Figure copying (n = 91)	14	44	14	19	0.19
m-BIT total (n = 101)	13	58	8	22	0.28
PN test (n = 101)	27	31	35	8	0.20

because a positive result may arise from other causes, such as hemianopia (20). Figure copying may relate to another aspect of UN than most other tests, because it requires a more complex motor performance from the patient (19).

The specificity of individual tests is poorly evaluated. The explanation seems to lie in the lack of a gold standard, and therefore the operational definition of UN remains unclear (21). On the other hand, for the clinician, it is more acceptable to have a low specificity than a low sensitivity, because the main purpose of a test in the clinical situation is to uncover discrete symptoms. The attention systems of the brain are complex. They involve both lateralized and non-lateralized mechanisms, and occur at several locations. The non-lateralized system has been called vigilance or sustained attention, and seems to be located in the posterior parietal lobe (22). A lowered non-lateralized attention can have important clinical implications, but when examining UN, we are most often interested in the lateralized systems. However, the cut-off criteria of certain test instruments, especially paper-and-pen tests, are often poorly designed to discriminate between the two. This can be partly overcome by adapting a demand of laterality as a cut-off criteria (11).

It is sometimes difficult to distinguish UN from a generally lowered cognitive performance. When interpreting BTT, there may be difficulties in some patients with cognitive impairment. These patients sometimes place the cubes in other formations than they are instructed to. Such formations may well be placed with predominance at one side of the board, and thus be misinterpreted as UN. However, diverging arrangement patterns of the cubes should be interpreted with caution.

Some comments on the interpretation of Kappa values in this study are of necessity. In the second sample of patients (Table II), the Kappa values are generally lower than in the first sample (Table I). That may be partially explained by repeated testing of a smaller number of patients, and the resulting Kappa values are therefore not directly comparable with the first sample.

Behavioural tests are generally more sensitive than paper-and-pencil tests, and therefore we recommend the behavioural tests be used in the first place when assessing UN. One behavioural test with a high sensitivity is the BTT. Some other tests that can be combined advantageously with BTT are Article reading and Figure copying. The latter seems to evaluate another component of UN than BTT, while Article reading more overlaps with BTT, but like the BTT make high demands on the patient's attentional level. On the other hand, we are reluctant to recommend Line bisection as an addition to BTT, because of its doubtful specificity.

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